Operational monitoring of pre- and postflight blood parameters for first time shuttle flyers

Shuttle astronauts receive medical evaluations 10 and 3 days before launch, on the day of landing, and 3 days after landing. These medical evaluations are performed for three purposes: 1) identification of occult disease before flight, 2) surveillance of health impacts, and 3) collection of normative data on biomedical parameters for use in flight operations. A wide variety of lab analytes (blood and urine chemistry, hematology, immunology, and endocrinology) are assayed during each evaluation.

Laboratory data collected three days before launch and on landing day were analyzed with regard to statistical significance and clinical relevance of the differences. The paired t-test was used to compare differences between preflight and postflight mean values. The results were presented at the 1997 Aerospace Medicine Annual Meeting.

The severity of space motion sickness had been reported to decrease with successive flights. First flight experiences influence behavior and use of countermeasures such as in-flight exercise, fluid loading, and G-suit use. Because of the possible influence of previous flight experience on response to subsequent flight, only first time flight experience was analyzed.

Nearly all lab parameters showed predictable changes following shuttle flights. More than half of the approximately 90 analytes were statistically significant at the 0.05 percent level. Data from some of the lab parameters which were statistically significant are presented in the table.

Lab Parameter	N	Normal Range	Mean at L - 3	Mean at R + 0	Mean Difference	Exact P Value
Glucose (mg/dl)	93	78 – 110	92	101	8.7	0.0001
Cholesterol (mg/dl)	88	125 – 199	200	194	−5.6	0.0109
Triglycerides (mg/dl)	89	40 – 197	91	83	−9.8	0.0034
Hemoglobin (gm/dl)	89	12.9 – 16.5	14.6	15.2	0.6	0.0001
Platelet Count (thou/mm^3)	88	132 – 348	255	272	14.5	0.0005
WBC Count (thou/mm^3)	89	2.9 – 8.2	6.2	7.5	1.3	0.0001
Cortisol (µg/dl)	78	4.5 – 30.9	17.86	14.67	−3.2	0.0005

These data demonstrate the importance of examining data for clinical relevance when a statistically significant result is reported. Although the t-tests were statistically significant at the 0.05 percent level, all lab parameters remained within normal ranges. For example, the normal range for serum glucose is 78 to 110 mg/dl. The group mean glucose value at L-3 (3 days before launch) was 92 mg/dl. The group mean glucose value at R+0 (landing day) was 101. Both of these group mean values are well within normal ranges. The difference between the group means is 8.7 mg/dl, that is, the R+0 group mean is 8.7 units greater than the L-3 mean value. Although this difference is significant at the 0.05 percent level (exact P value = 0.0001 percent), it is not clinically important. There is no health impact from this small temporary increase in serum glucose.

There are many factors that may influence postflight lab parameters. In-flight factors include space motion sickness, fluid shifts, neurovestibular and cardiovascular changes associated with weightlessness, diet, medications usage, in-flight illness or injury, fatigue, circadian dissynchrony, exposure to environmental toxins, and mission duration. Factors encountered during

Secondhand smoke and you

What is secondhand smoke?

Secondhand smoke is a combination of the smoke breathed out by smokers and the smoke from the burning end of a cigarette, cigar, or pipe. Secondhand smoke is also called environmental tobacco smoke or sidestream smoke. Exposure to secondhand smoke is called involuntary smoking, or passive smoking. Secondhand smoke is classified by the Environmental Protection Agency as a known human carcinogen.

Secondhand smoke contains more than 4,000 substances, more than 40 of which are known to cause cancer in humans and many of which are strong irritants. Carbon monoxide is a poisonous gas that is also found in car exhaust fumes. Nicotine is a stimulant and an addictive drug. Tar is a sticky mixture of chemicals that cause cancer. Secondhand smoke also contains pesticides, polycyclic aromatic hydro-carbons, metals such as arsenic, and ammonia.

The amount of smoke a nonsmoker breathes in depends on how close they are to the smoker(s), the size of the room, the number of smokers in the room, if the windows are open, if there are extractor fans, and the number of cigarettes smoked.

What effect does secondhand smoke have on you?

Secondhand smoke causes irritation of the eyes, nose, and throat. It can also irritate the lungs, leading to coughing, excessive phlegm, chest discomfort, and reduced lung function. Second-hand smoke is a contributing factor in about 3,000 deaths each year from lung cancer in people who don't smoke (never smoked and former smokers).

Two components of secondhand smoke that may increase the risk of heart disease are carbon monoxide and nicotine. Carbon monoxide competes with oxygen for binding sites on red blood cells. This reduces the amount of oxygen in the heart and compromises the heart's ability to use oxygen efficiently. Nicotine activates blood platelets, which increases the risk of blood clots, damages the lining of coronary arteries, and promotes the development of atherosclerosis. Secondhand smoke has been linked with the onset of chest pain and is associated with death from heart disease in 37,000 people each year. It is estimated that 90,000 to 180,000

Crossword
Secondhand Smoke and You
Answers on page 4
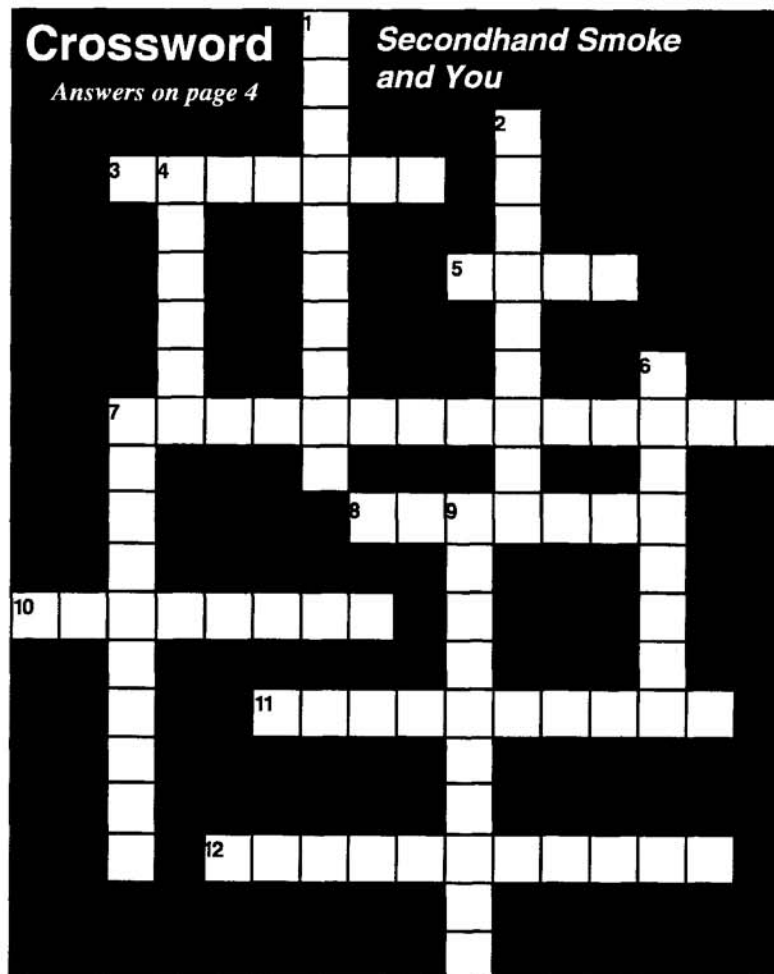
ACROSS

3. Exposure to secondhand smoking is also called _____ smoking.
5. Try to help smokers _____.
7. Poisonous gas found in cigarette smoke and car exhaust fumes.
8. Secondhand smoke is formed by burning _____.
10. _____ are more severely affected by secondhand smoke than are adults.
11. Secondhand smoke is a contributing factor in 3000 deaths from _____ _____ annually.
12. Irregular heartbeats.

DOWN

1. Secondhand smoke causes _____ of the eyes, nose, and throat.
2. Serious respiratory tract infection associated with exposure to seciondhand smoke.
4. Children exposed to secondhand smoke are more likely to develop _____.
6. A stimulant and an addictive drug found in tobacco products.
7. A cancer-causing agent is called a _____.
9. Serious lower respiratory tract infection.

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non-fatal heart attacks and 30,000 to 60,000 fatal heart attacks each year are associated with secondhand smoke.

People exposed to secondhand smoke show a reduced exercise capability. People with existing heart disease cannot exercise as hard or as long when exposed to secondhand smoke and are more likely to develop arrhythmias (irregular heart beats). People with no signs of heart disease take as long as those with heart disease to return to their resting heart rate following exercise when exposed to secondhand smoke.

Children have more delicate lungs than adults and are more affected by secondhand smoke and the chemicals it contains. Children who breathe secondhand smoke have more ear infections, tonsillitis and sinusitis. They are more likely to develop asthma. An estimated 8,000 to 26,000 new cases of asthma annually are attributed to exposure to secondhand smoke. Children who have asthma and who breathe secondhand smoke have more asthma attacks. The Environmental Protection Agency estimates that between 200,000 and 1,000,000 asthmatic children have their condition made worse by exposure to secondhand smoke. Children who breathe secondhand smoke are also more likely to suffer from pneumonia, bronchitis, and other lung diseases. There are an estimated 150,000 to 300,000 cases every year of serious lower respiratory tract infections, such as bronchitis and pneumonia, in children under 18 months of age who breathe secondhand smoke. Of these infections, between 7,500 and 15,000 require hospitalization.

What can you do to protect yourself from secondhand smoke?

Don't smoke in your home. Ask smokers politely not to smoke when they are near you, especially when you are indoors or in a car. If they don't stop smoking, move away yourself. If someone must smoke inside, limit them to rooms where windows can be opened or fans can be used to send the smoke outside. In restaurants and bars, ask to sit in the non-smoking area. JSC is a smoke-free workplace, but if you do not work at JSC, ask your employer to make sure you do not have to breathe other people's smoke at work. Help people who are trying to quit smoking.

For more information on the Freedom From Smoking programs or programs to quit smoking, contact your local American Lung Association at 1-800-LUNG-USA (1-800-586-4872).

The following publications were referenced for this article:

<u>When You Can't Breathe, Nothing Else Matters</u>. American Lung Association. 1997

<u>Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders</u>. U.S. Environmental Protection Agency. NIH Publication No. 93-3605. 1993

<u>Passive smoking and heart disease</u>. Glantz SA, and Parmley WW. JAMA 1995;273(13):1047 - 1053

LSAH plans data collection for nutrient intake

Studies, such as the LSAH, that include the collection of baseline data for future outcome analysis of chronic diseases, frequently incorporate some measure of nutrient intake. Relationships have been reported between both cancer and heart disease and a number of micronutrients, including vitamins A, C, E, carotenoids, folacin, selenium, and zinc. Other dietary components of potential significance with respect to chronic diseases include total calories, total fat, percent of calories derived from fat, polyunsaturated fatty acids, cholesterol, dietary fiber, alcohol, and others. To examine the relationship between diet and disease, or to control for the confounding effects of diet when examining the relationship between other exposures and disease, data are needed at the level of the individual. Even though group data will be reported, categorization of individuals into subgroups is necessary in order to accomplish statistical analyses of the association of nutrients with outcomes.

There are several methods used by researchers to collect dietary data.

Twenty-four hour recalls of dietary intake during the past 24 hours provide information for a specific slice of time. They are useful when group information is needed and when the outcomes of interest are group rather than individual outcomes. For example, programs designed to change the dietary habits of school children as a whole may use 24-hour recalls to examine changes in group behavior over the course of the program.

Diet records are reports of dietary intake that are recorded as food is consumed. This method is more accurate than a 24-hour recall because it is very easy to forget the details of exactly what and how much was eaten a day later. If one- or two-day diet records are collected intermittently throughout a long period of time, a good estimate of usual dietary intake by an individual may be obtained. The validity of the data is dependent on the total number of days the records include. Diet records require a high degree of commitment by the participants to perform the record keeping conscientiously. *continued on page 4*

reentry include exposure to G-forces following prolonged weightlessness, heat stress caused by the suits worn, and fluid loading. Postflight factors include varying time lag between landing and collection, crew activities scheduled in the postflight period, and consumption of fluids and food after landing, but before sample collection.

Many of the differences between preflight and postflight lab parameters can be explained by physiologic stress, hemoconcentration, and relative hypovolemia, which are experienced in the short-term by space participants. An important confounding factor is that the preflight serum samples were collected following a 12 to 14 hour fast. Postflight serum samples were collected after a meal (breakfast) and fluid loading and possibly food intake between landing and blood draw.

In conclusion, the differences between preflight and postflight measurements can be attributed to any of the factors described above. However, the differences appear to be too small to be clinically significant. Future analyses will examine the recovery curve between R+0 and R+3 because crew members typically return to duty and return to flight status after R+3.

Food frequency questionnaires can be used to categorize individuals broadly with respect to usual intake. The addition of an assessment of portion size to a food frequency questionnaire results in a **diet history questionnaire** that provides a more accurate nutrient estimate.

Diet histories involve the recognition and reporting of a pattern of behavior rather than remembering the instances of eating specific foods. A list-based diet history can be completed by the participant without assistance. The participant is prompted with a list of specific foods and the frequency of consumption and portion size is identified for those foods reported to be consumed. The adequacy of this method of obtaining usual dietary intake is dependent on the appropriateness of the list of foods.

The measurement of nutrient intake is difficult and there is likely to be some misclassification and some imprecision in each of the data collection methods. The diet history questionnaire method most closely meets the needs of this study. LSAH is in the process of examining several diet history questionnaires that have been validated in other projects. A pretest of one or more of these questionnaires will be completed in a subsample of the LSAH population and redesign will be done, if necessary, to fit a questionnaire to this population. The collection of usual dietary intake will expand the ability of the LSAH database to provide analyses of occupational exposures to future outcomes while controlling for risk factors that are not directly related to occupation.

The nutrient intake data needed by LSAH differs from that needed by the NASA Nutrition group. The Nutrition group is concerned with assuring that intake is sufficient to meet the nutritional needs of crewmembers during flights and other job specific tasks. LSAH is concerned with collecting data that represent the usual, long-term nutrient intake and relating that intake to lifelong disease outcomes. Therefore, the method of measuring nutrient intake may differ significantly and the handling of the data will differ. We try to collect data as unobtrusively as possible but some of you may be asked to complete dietary intake questionnaires or records in what may seem to be a repeated effort. We appreciate your efforts to support the long-term efforts of this study.

Crossword Answers

ACROSS: 3. Passive; 5. Quit; 7. Carbon Monoxide; 8. Tobacco; 10. Children; 11. Lung Cancer; 12. Arrhythmias

DOWN: 1. Irritation; 2. Pneumonia; 4. Asthma; 6. Nicotine; 7 Carcinogen; 9. Bronchitis

For your information

If you want a copy of your exam results, please complete and sign a release form while you are visiting the Clinic for your examination. The form is called *Privacy Act Disclosure Authorization and Accounting Record (DAAR)*, or NASA Form 1536.

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